How To Remove Odors From Well Water

A Practical Guide To Eliminating Odors In Well, Spring and Cistern Waters

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How to Treat Sulfur Odors In Well Water

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Water containing hydrogen sulfide gas (H_2S) has a distinctive "rotten egg" odor, which may be especially noticeable when running hot water. Such water can discolor beverages like coffee and tea, and alter the appearance and taste of cooked foods.

Hydrogen sulfide gas is a nuisance. Though it is not usually a health risk at concentrations normally found in household water, hydrogen sulfide is flammable and poisonous, and can be toxic.

If enough hydrogen sulfide gas is released in a confined area, it can cause nausea, illness, and in extreme cases, death. However, the gas can usually be detected long before it reaches harmful concentrations.

H_2S dissolved in water can corrode plumbing metals (iron, steel, copper, and brass) and exposed metal parts in washing machines and other water-using appliances.

The corrosion of iron and steel from hydrogen sulfide forms ferrous sulfide or "black water," which can darken silverware and discolor copper and brass utensils. Hydrogen sulfide can also interfere with the effectiveness of water softeners and filter systems.

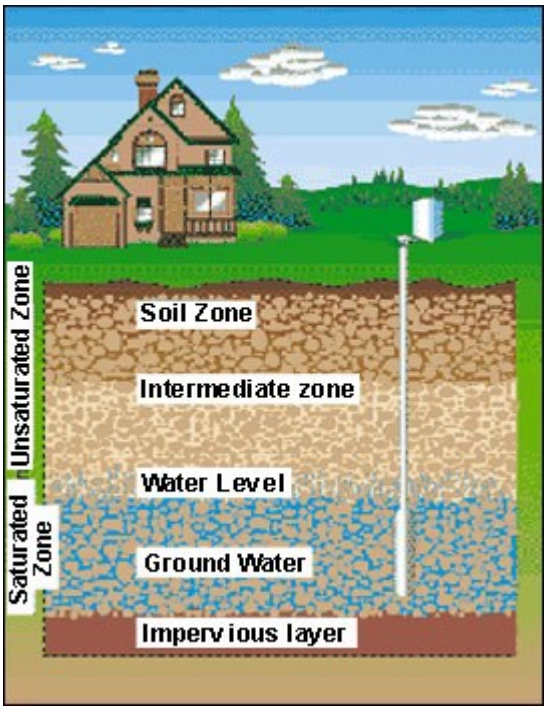
Sources of Hydrogen Sulfide

Iron and sulfur bacteria present in groundwater use iron and sulfur as an energy source and chemically change sulfates to produce H_2S gas. These bacteria use the sulfur available from decaying plants, rocks, or soil, and often thrive in iron-rich environments.

The harmless, non-toxic bacteria normally exist in oxygen-deficient environments, such as deep wells and plumbing systems. The bacteria do not usually cause health problems, but contribute to bad tastes and/or odors at low levels.

Hydrogen sulfide gas may also be present naturally in wells drilled in shale or sandstone, near coal or peat deposits, in oil fields, and in sewage. Though H_2S is normally found in wells, it can also enter surface water through springs and quickly escape into the atmosphere.

Water heaters can also become a source of foul H_2S odors. The magnesium rod used in heaters for corrosion control can chemically reduce sulfates to H_2S.



Sulfur-related bacteria thrive in the oxygen-starved environments of deep wells.

Black or rusty slime and stringy deposits in toilet flush tanks (above) indicate the presence of sulfur and/or iron related bacteria.

Clean Water Systems has served many thousands of satisfied customers worldwide since 1985. We are dedicated to providing our customers high quality water treatment systems at the lowest cost.

Test Your Water

If there is an odor problem with the water supply, the first step is to determine the source. If the source is from the well directly, a general mineral water analysis is critical to select the correct system.

Test should include analysis for pH, iron, manganese, hardness, total dissolved solids, and oxidation-reduction potential at a minimum. Additional tests for sulfate, hydrogen sulfide, and tannin is recommended as well. Take the sample as close to the well as possible.

With these results you can identify the best type of water treatment to use, and what type of system to select, based on your water chemistry. **Avoid in-home water testing by water softener salespeople during sales demonstrations.**

Your water should also be tested for total coliform and e-coli (fecal coliform) to prevent health issues. If infants and children will be drinking the water, a complete general, mineral, metals and bacteriological test is recommend.

If the source of water is a public water system and you experience problems with odor, it is important to contact a utility official to determine whether the odor is from the public system or from your home's plumbing or piping.

Low cost do-it-yourself test kits are easily available, allowing you test for common problems right in your own home.

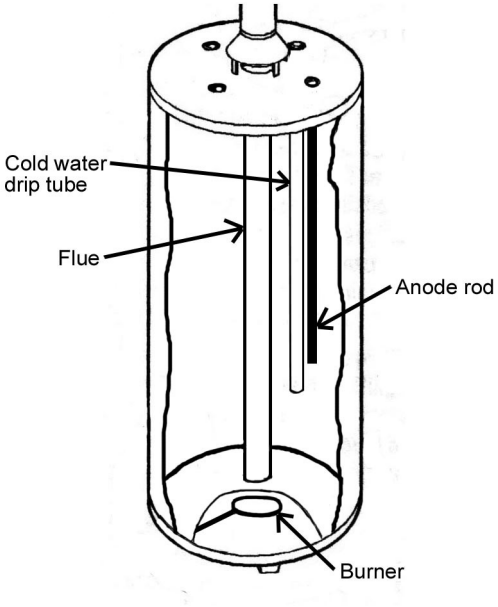
Comprehensive laboratory testing can test your water for general minerals and physical and chemical contaminants.

Check For Odors in Cold & Hot Water

Run a hose bib or tap as close to the well as possible, fill a 5-gallon bucket or other container, and check for odors. If you smell a "rotten egg" odor, this is hydrogen sulfide gas. If water smells like oil or asphalt this can be from manganese. If water smells like cucumber or sewage this is usually a result of iron and/or sulfur bacteria.

Run hot water from each tap to determine if there is an odor in the hot water that is not in the cold water. This indicates a problem with the water heater. Iron and sulfur bacteria can interact with the anode rod in water heaters, resulting in hydrogen sulfide gas only in the hot water. Changing the anode rod to an aluminum rod can often solve this problem.

It is recommended that you drain your water heater at least once per year. This will flush out sediment that may accumulate in the bottom and give you an idea of your sediment's type and color, if any is present.



Water heaters can accumulate rust and sludge. Iron and sulfur bacteria can create sulfur odors in water heaters.

Perform a "Toilet Tank Inspection"

Unless your it is new or has recently been cleaned, your toilet flush tank can be a wealth of useful water quality information! Simply lift the cover and look in. If you see slimy rust deposits on the sides of the tank and frothy bubbles in the tank water, this may indicate the presence of iron or sulfur bacteria which can create sulfur and other odors in your water.

Symptom	Cause	Solution
White scale on float	Calcium hardness	Water softener
	Total dissolved solids	Reverse osmosis
Tank sides are white, but black, rust, or sand is laying on the bottom	Decaying galvanized pipes	Replace pipes; correct corrosiveness of water
	Sand, rust or sediment in well water	Sediment and/or iron filter
Blue stains	Acidic (low pH) water	Calcite neutralizer or soda ash feeder
Rust stains	Iron	Iron filter (Birm, MangOX, Greensand, Pyrolox)
Furry, stringy red growths	Iron (and/or other) bacteria	Chlorination, aeration, ozone injection, hydrogen peroxide, followed by filtration
Furry, stringy gray or black growths	Sulfur (or other) bacteria	Chlorination, aeration, ozone injection, hydrogen peroxide, followed by filtration
Frothy, with bubbles	Iron bacteria	Chlorination, aeration, ozone injection, hydrogen peroxide, followed by filtration
Brown stains	Iron and/or Manganese	Iron filter that removes manganese (MangOX, Greensand, Pyrolox)
Black stains	Iron and/or Manganese	Iron filter that removes manganese (MangOX, Greensand, Pyrolox)
	Ferric Sulfide (black rust)	Iron filter (Birm, MangOX, Greensand, Pyrolox)
Pink stains	Airborne bacteria	Not water quality related; Clean with chlorine bleach

Sanitize Your Well With Chlorine Bleach

Shock chlorination with chlorine bleach will kill odors temporarily. This involves injecting a 50 to 200 ppm dose of chlorine into the well, pump system, and piping. The chlorine is then allowed to sit in the well for 6 to 24 hours, at which time the water is flushed out until the chlorine is gone. When the odor returns, usually in a couple of days to a couple of weeks, the procedure can be repeated. If the odor is still present after multiple chlorine shock treatments, an odor removal system such as continuous chlorination, air injection and/or filtration is needed.

1. Clean the well house or springhouse thoroughly, as well as any storage tank or reservoir you may have. Remove debris and scrub or hose off any dirt or other deposits on interior surfaces. Pump to remove any suspended solids or foreign matter in the water if possible. Scrub interior surfaces with a strong chlorine solution containing ½ gallon household bleach, or ¼ gallon of pool chlorine, for each 5 gallons of water.
2. Determine how much chlorine you'll need to disinfect your well by consulting Table 1. If using pool chlorine (12% sodium hypochlorite) use half as much chlorine bleach. If using powdered well sanitizer, consult the manufacturer's guidelines. If you don't know your well depth, contact your well driller as they often keep records that will list the depth of the well.
3. Mix the chlorine bleach with 10 times as much water before pouring down well. Avoid pouring strong bleach down well.
4. Open the well cap, or if your well has a well top seal, remove the ½" plug or air vent and use a large funnel to pour chlorine down well. CAUTION: well caps and seals are integral to the safety and integrity of your well. They are often regulated by state and local codes. Be certain to comply with all applicable codes and licensing laws whenever opening a well. If you are unsure of any of the following steps, seek the assistance of a qualified or licensed well driller or pump installer/contractor.
5. Do not attempt to remove the sanitary well seal (note this is not the well cap mentioned above) without the assistance of a qualified well driller or pump contractor. Do not loosen the bolts that compress the seal.
6. Wells equipped with a packer jet pump can be thoroughly disinfected only though the removal of the pipe, pump, and jet unit from the well.
7. As you are adding the chlorine solution, take precautions to protect yourself from splashing chlorine and fumes. Protect your eyes with safety goggles, and wear protective gloves and clothing.

Table 1—How much household bleach to use

Well Casing Diameter	Distance From Water Level to Bottom of Well (Water Depth)					
	0' – 50'	50' – 100'	100 – 200'	200' - 300'	300' – 400'	400' – 500'
4"	8 oz.	½ qt.	1 qt.	2 qt.	¾ gal.	¾ gal.
6"	½ qt.	1 qt.	¾ gal.	1 gal.	1 ¼ gal.	1 ½ gal.
8"– 12"	½ gal.	¾ gal.	1 ¼ gal.	1 ¾ gal.	2 ½ gal.	3 gal.
12" – 16"	½ gal.	1 gal.	2 gal.	3 gal.	4 gal.	5 gal.
20" - 24"	1 gal.	3 gal.	5 gal.	7 gal.	9 gal.	11 gal.
30" – 36"	3 gal.	5 gal.	10 gal.	15 gal.	20 gal.	25 gal.

NOTES OF CAUTION: While shock chlorination may correct bacteria and/or odor problems in wells and piping systems in the short term, it does not correct the source of the bacterial contamination.

CAUTION: well caps and seals are integral to the safety and integrity of your well. They are often regulated by the state and local codes.

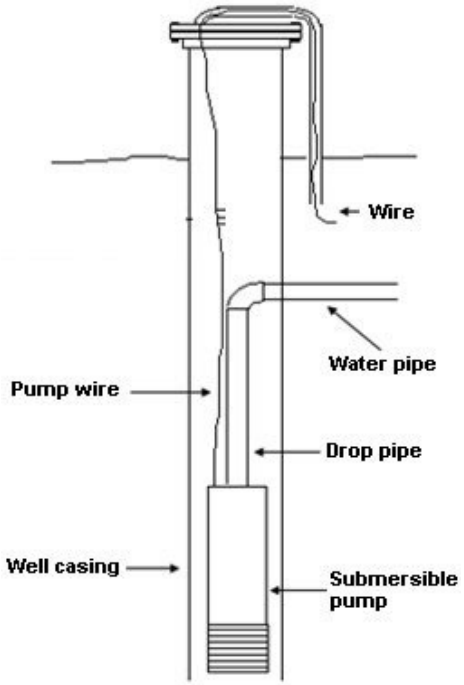
Be certain to comply with all applicable codes and licensing laws, whenever opening a well. If you are unsure of any of the following steps, seek the assistance of a qualified or licensed well driller or pump installer or contractor.

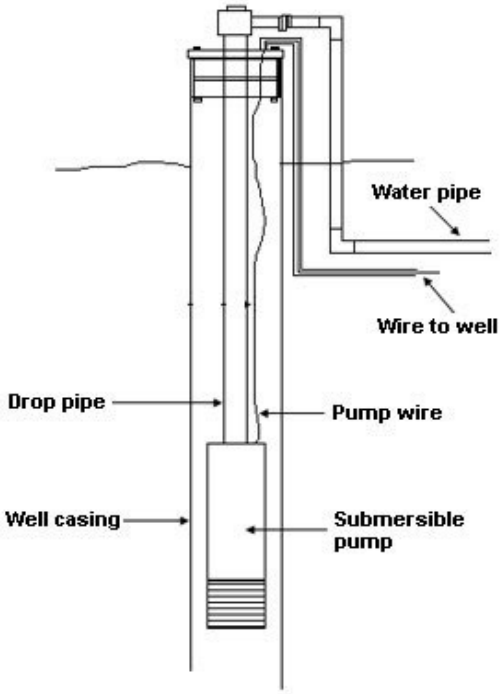
CAUTION: Heavily fouled wells can sometimes clog pipes and cause damage to pumps during or after shock chlorination. While this is rare, consult a well contractor or pump company if you notice any loss of pressure or water flow after chlorinating a heavily-fouled well.

Sanitize Your Well with Chlorine Bleach (cont.)

8. As you are adding the chlorine solution, take precautions to protect yourself from splashing chlorine and fumes. Protect your eyes with safety goggles, and wear protective gloves and clothing.
9. Pour the chlorine solution down the well. Avoid pouring the chlorine solution on the pump wire connectors. If in doubt, use dry chlorine pellets.
10. If the well is relatively deep, the disinfectant may be dispersed to the bottom by alternatively starting and stopping the pump several times.
11. Add more bleach as needed to bring up the chlorine solution residual in the well to 50 to 200 ppm.
12. If possible, circulate the water from the well by connecting a garden hose to a nearby hose bib or sill cock, and feed the water back down into the well. This will also wash down the sides of the well and ensure proper mixing. After approximately 15 minutes a strong chlorine odor should develop. To be more precise, use a chlorine test kit to make sure the chlorine is over 50 ppm.
13. Water should be pumped from the well into the pressure tank and plumbing system in the house to run sanitizer throughout the system.
14. All water faucets should be turned on in the house and all outside fixtures and hose bibs (including fire hydrants, watering troughs, supply lines to other buildings, etc.) until a 50 ppm chlorine residual is detected.
15. At this point, turn off your fixtures and let the chlorine remain in the pipes a minimum of 2 hours, up to 24 hours or overnight.
16. After the chlorine has been left in the well and the plumbing system (if applicable) for a minimum of two hours, the chlorinated water can be discharged.
17. If possible, discharge the water through an outside faucet with hose attachment. Do not discharge the chlorinated water into streams or rivers. The small amount of chlorinated water which remains in your household plumbing can be discharged into a septic system.
18. Large amounts of chlorinated water should not be discharged into septic systems, or onto lawns or gardens.
19. Backwash water softeners, flush the water heater, and replace all filters if present.
20. For wells and piping systems that have bacterial contamination or have been flooded, resample the water and retest for coliform after all the chlorine residual is gone.

Wells with submersible pumps have pipes that enter either through the top or through the side. Many wells are underground or in vaults, particularly in areas with freezing temperatures.



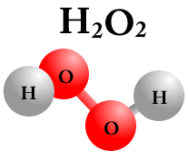


Common Oxidizers Used for Eliminating Odors

Odors are eliminated by first applying an oxidant, followed (usually) by filter media. In some cases filter media alone can be used if the odor is very slight.

Sulfur odors (hydrogen sulfide gas) are often caused by sulfur-related bacteria; if these bacteria are not removed, odors can recur even after filtration. Generally it is best to use a disinfecting oxidant such as chlorine, hydrogen peroxide, or ozone, to eliminate the odor permanently.

Oxidant	Best filter media to use with oxidant
Aeration	Catalytic Carbon or MangOX
Hydrogen Peroxide	Catalytic Carbon
Chlorine Bleach	Standard Activated Carbon, Greensand or MangOX
Ozone Gas	Catalytic Carbon, Greensand or MangOX
Potassium permanganate	Greensand



Hydrogen peroxide is a powerful oxidizer. It is made of hydrogen and oxygen and readily adds oxygen to water, eliminating odors and killing bacteria without adding any chemical residues.

Oxidant Types

- Aeration
- Chlorine
- Hydrogen peroxide
- Potassium permanganate
- Ozone

Filter Media Types

- Activated carbon
- Catalytic carbon
- Greensand
- MangOX, Filox, Pyrolox
- KDF

Oxidant Type	Best pH range	Kills bacteria?	Minutes of contact time required*	Advantages	Disadvantages
Aeration	5.0-7.0	No	3-10	Low cost; safe	Weakest oxidant; does not kill sulfur bacteria; adds gasses to water which must be vented off.
Hydrogen Peroxide	6.0-8.5	Yes	1-2	Fast working; no chemical residual in water; safe; no aftertastes	Moderate expense to buy peroxide on an annual basis.
Chlorine Bleach	6.0-7.4	Yes	5-10	Low cost, leaves chlorine residual for down-stream disinfecting	Puts sodium into water; slow acting; very pH dependent; can create trihalomethanes and other toxic residuals
Ozone Gas	6.0-8.0	Yes	1-2	Fast working; does not leave a chemical residual in water; safe	High cost of ozone systems; adds gasses to water which must be vented
Potassium permanganate	6.5-7.4	No	5-10	Good at eliminating wide variety of odors	Pink water; can be toxic if overused; needs to be used with greensand; causes severe staining if not handled properly

Estimate. Also depends on pH and temperature

Aeration

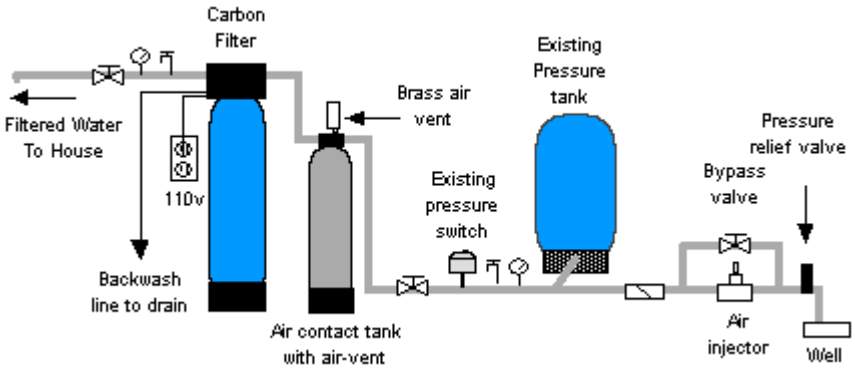
Aeration is a well-established method of eliminating odors from water. There are there 3 main methods for residential applications:

1. Air injection by air-charger type iron or sulfur filter.
2. Air injection by venturi injector
3. Air injection by compressor in a closed pressure tank
4. Air injection by compressor in an open storage tank

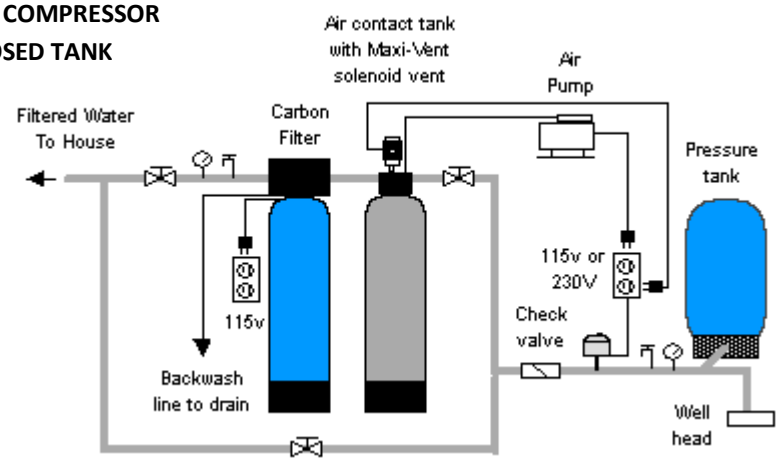
Auto-backwashing air-charging catalytic carbon filters use a head of air inside the tank, and a high-grade coconut shell catalytic carbon media to remove hydrogen sulfide odors and sediment.

Air compressor for blowing air through ceramic diffuser stone in storage tanks. An ozone generator can be installed between your air compressor and diffuser stone to increase the amount of oxidation over plain air.

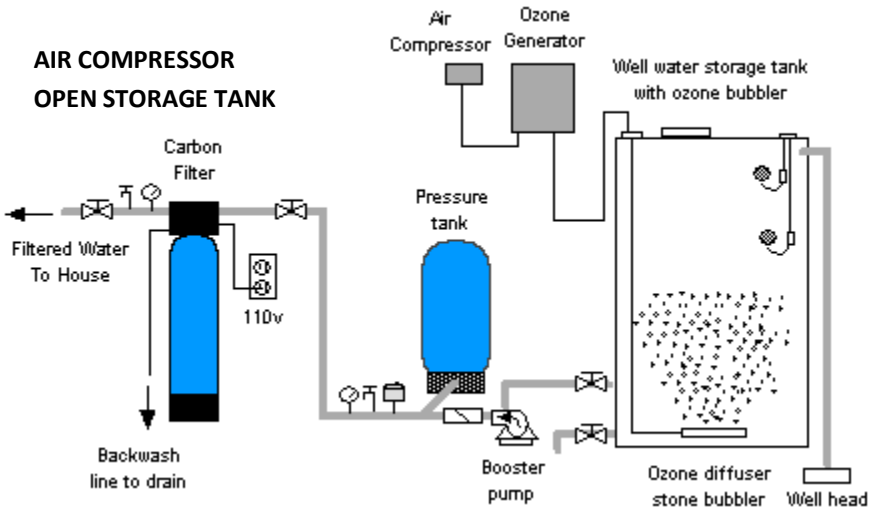
VENTURI AIR INJECTOR



AIR COMPRESSOR CLOSED TANK



AIR COMPRESSOR OPEN STORAGE TANK



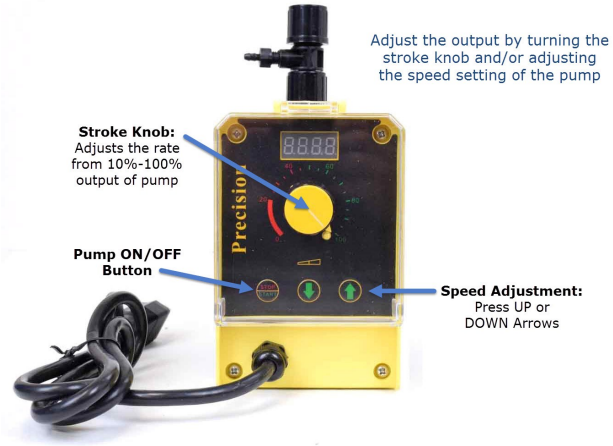
Chlorine: Liquid Bleach Pumps

Chlorine injection is a very effective, low cost way to eliminate odors and kill odor-causing bacteria from well water. If desired, the chlorine can be easily filtered out with activated carbon so there is no chlorine residual in the household water or being flushed into the septic tank.

Metering pumps are used to inject a small amount of chlorine (sodium hypochlorite solution, or calcium hypochlorite solution) into the water, usually in conjunction with a contact tank. The pumps draw chlorine bleach from a solution tank and pump it into a pipe under pressure.

If you know your line pressure you can determine if the pump are you are selecting is suitable for your pressure. Most metering pumps can handle up to 125 PSI, which is more than enough for most home well systems.

Chlorine Solution Tank with Metering Pump



Typical Home Chlorination System. Chlorine is injected prior to the pressure tank. Each time the well turns on, the chlorine pump turns on and injects a tiny amount of chlorine bleach into the water. The water then flows through the contact tank, where it has time for the odors, bacteria and iron to be oxidized. It then flows through the iron filter, and a backwashing carbon filter. The result is clean, clear, odor-free, disinfected, chlorine-free water throughout the home.

Contact tank (provides time for chlorine to work)

Chlorine pump

Chlorine bleach solution tank

Carbon Backwash Filter (removes chlorine residual)

Iron Filter (with Pro-OX or Greensand filter media)

Determine Chlorine Solution Strength and Metering Pump Size for Liquid Bleach Systems

Step 1: Determine flow rate of the water stream you are injecting into, in Gallons Per Minute (GPM) or Liters Per Minute (LPM).

Step 2: Determine the parts per million of chlorine you are trying to achieve (PPM). This is the chlorine residual based on estimated chlorine demand.

Step 3: Use the formula below to compute the gallons per day and select the pump. Pumps are sized in gallons output per 24 hours (gallons per day).

Step 4: Adjust the output of the metering pump to achieve proper dosage.

Formula: Multiply the Flow Rate (in gallons per minute) times the Applied Dosage in Parts Per Million Desired times 1440. Then divide by the Solution Strength being used. [Also expressable as: (Flow Rate GPM X Chlorine PPM x 1440) / Solution Strength in PPM.]

Example Formula : Assume that you have a well pump that has a flow rate of 12 gallons per minute (12 GPM) and that you want to inject 3.0 ppm of chlorine into the water.

You have decided to use a solution strength of 25,000 ppm, or 1 gallon of 5% bleach to one gallon of purified (or at least softened) water.

There are 1440 minutes in a 24 hour period, so this formula will tell you how many gallons of chlorine you will use for every 24 hours the well pump runs.

The formula in this example is thus:
(12 GPM x 3.0 PPM x 1440) / 25,000 = 2.07 Gal. Per Day

This means that you need a metering pump that has an output of 2.0 gallons per day. You can use the Stenner 45MHP2, which has a maximum output of 3 gallons per day, and set the pump at the 66% level, since 2 is 66% of 3, the maximum output of the pump. The Stenner pump has a Feed Rate Control Dial with numbers from 1 to 10. If you set the pump at 6 or between 6 and 7, you will have the desired adjustment of 66%.

Your well pump might run for 1 hour a day, so at this rate you would use 2.0 gallons of your chlorine bleach solution every 24 hours that the pump runs. It is better to add more solution every one to two months as the solution can lose its potency over time.

Whatever your initial setting, be sure to test for total and free-chlorine and then adjust the pump and/or the solution strength to achieve the desired free-chlorine residual in your piping.

Liquid chlorine bleach (sodium hypochlorite):

- Easy to use and mix
- Mixes and dilutes rapidly
- Use certified chlorine for drinking water, or make your own liquid bleach with NSF-certified dry powdered bleach.
- Lower cost than dry chlorine
- Needs to be kept away from sun and heat
- Decays rapidly, use within 1 to 3 months for best results.

Pool bleach or commercial grade chlorine bleach is typically 10% - 12% chlorine, or 100,000 PPM - 120,000 PPM.

Household bleach is not for potable water systems, as it may contain contaminants such as benzene.

Dry chlorine bleach (calcium hypochlorite)

NOTE: If you cannot find "certified bleach' that is specifically for drinking water, you can use powdered NSF-certified bleach to make your own liquid bleach. It should be easily available in most areas.

Estimate Chlorine Demand

When chlorine is added to water it reacts with impurities, such as hydrogen sulfide, soluble metals, particles of organic matter and microorganisms. The chlorine demand must first be satisfied, before a residual chlorine concentration can be established.

For odor control a combination of chlorine injection, a contact tank to allow some retention time, and an activated carbon filter works well for residential water systems. The best approach is to add enough chlorine so there is 0.2 to 0.8 PPM of chlorine residual detected, after the contact tank and before the activated carbon filter.

Chlorine demand is simply how much available or "free" chlorine in mg/L or PPM is needed to kill bacteria, remove odor, and/or oxidize iron, in order to achieve your goals.

Typical amount of chlorine required to oxidize hydrogen sulfide odors, kill bacteria and oxidize iron, manganese:

Example: Common well water analysis and chlorine demand calculation:

Contaminant	Amount of free-chlorine in mg/L	Estimated contact time required if pH is 6.0 to 7.5 Temp @ 10C*
Hydrogen Sulfide 1 mg/L	2.0 to 3.0	2 to 6 minutes
Iron 1 mg/L	0.6 to 1.0	2 to 6 minutes
Manganese 1 mg/L	1.7 to 2.0	2 to 6 minutes
Bacteria	2.0	6 to 10 minutes

* Based on CT Values recommended by USEPA. CT value is Concentration of chlorine multiplied by Time in retention. C x T = CT value. The less Concentration of chlorine you have, the longer the contact Time required.

Contaminant	Concentration	Multiplier		Total
Hydrogen Sulfide	2.0 mg/L	x 3	=	6.0
Iron	2.0 mg/L	x 1	=	2.0
Manganese	0.2 mg/L	x 2	=	0.4
Coliform Bacteria	Present	x 2	=	2.0
	Total Applied Chlorine Dose			10.4 mg/L

Note, calculations for Chlorine Demand do not have to be exact. Once the system is up and running, a simple free-chlorine test after your contact tank will let you know your chlorine demand. The chlorinator can be then be easily adjusted to put out more or less chlorine as needed.

pH:

Chlorine is most effective if the water has a pH in the range of 6.0—7.5. At pH 8.0 much more chlorine is required to have the same effect than if the water had a pH of 7.0. At pH over 8.5 chlorine becomes more ineffective as a disinfectant .

Temperature:

The warmer the water, the more effective free-chlorine is in disinfecting water and oxidizing iron. Colder water less than 10C (50F) requires longer contact times and higher concentrations of chlorine than examples shown.

CT Values:

CT values have been set by USEPA and WHO guidelines to show how much Concentration of chlorine and the Time that is required to inactivate bacteria and viruses. C x T = CT. See page 11 for more information.

Chlorine Bleach: Solid Pellets & Powders

In-Line or Well-Mount Pellet Feeders

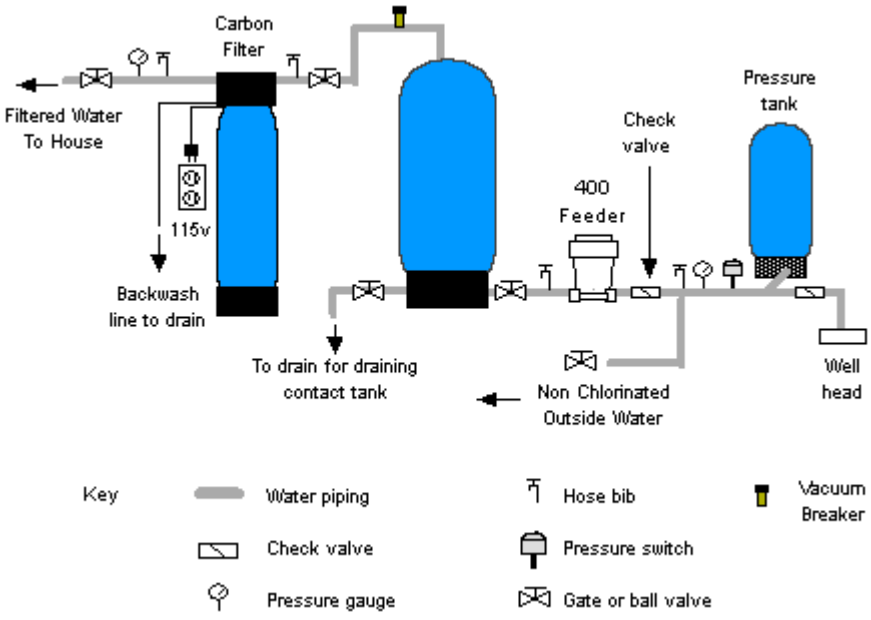
Calcium hypochlorite is used in solid pellet chlorinators. Calcium hypo is 65% chlorine and a very strong oxidizer.

The **Model 400 In-Line chlorinator** will operate on varying pressure such as in a home well system or on constant pressure such as in a sprinkler or pool system. The chlorinator is adjustable, but the exact dose cannot be controlled as easily as the liquid chlorinators using a metering pump. Often the minimum adjustment allows a chlorine residual of 3—5 ppm to enter the water, so a contact tank and a carbon filter are recommended after the system, especially if used for residential applications.

In-Line Feeders are installed on the pipe after the pressure tank:

- No electrical power required
- Easy to fill and re-fill
- Easy to install and adjust
- Heavy iron may foul the pellet feeder
- Very hard water may cause feeder to clog with calcium build-up

Typical installation in which the in-line solid pellet chlorinator is installed after the pressure tank and before the contact tank.



Well-mount chlorine pellet drop systems drop pellets down the well automatically when the well pump runs.

Well-Head Pellet Feeders:

- Mount on top of well
- Easy to fill and re-fill
- Easy to install and adjust
- Use well as contact tank
- May help well resist fouling from iron bacteria slime.
- Excess pellet feeding may cause damage to well pumps

Hydrogen Peroxide

Hydrogen peroxide (H_2O_2) is a powerful oxidizing agent, much more powerful than aeration, chlorine, or potassium permanganate. Hydrogen peroxide kills odors and then decomposes into oxygen and water, leaving no trace of chemical residues.

When peroxide is added to water a large amount of dissolved oxygen is released and a powerful oxidizing effect occurs.

Peroxide oxidizes the sulfur odors to a solid form that the catalytic carbon can remove. For many applications no contact tank is required, and the hydrogen peroxide is effectively removed by the catalytic carbon media.

Peroxide Solution Tank & Pump with Degassing Valve

Hydrogen peroxide 7% is not dangerous to handle and breaks down into oxygen and water

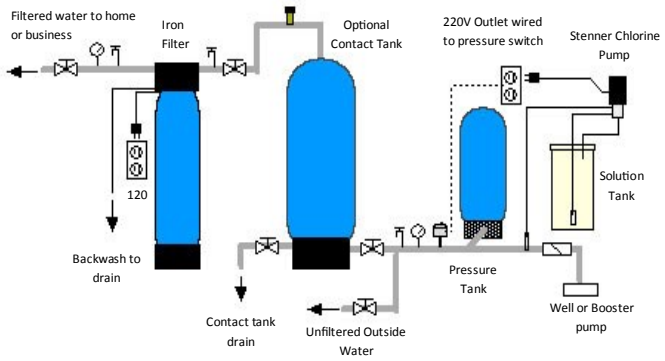
Catalytic Carbon Filtration Systems remove any trace of peroxide and sediment after the water has been treated with hydrogen peroxide

- Eliminates “rotten egg" odor
- Adds only oxygen & water
- Low maintenance

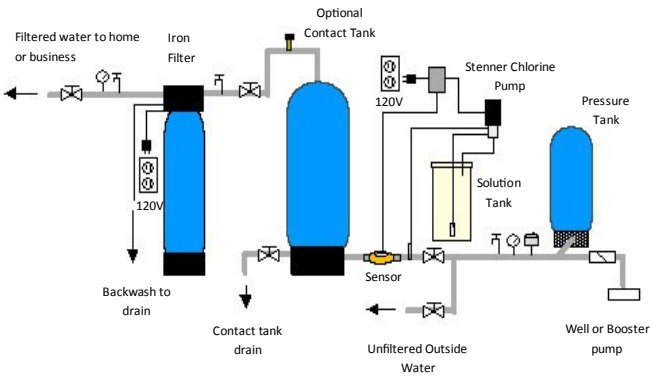
Two common methods of injecting hydrogen peroxide:

- Inject before pressure tank: peroxide pump turns on by pressure switch (is wired to same circuit as well pump)
- Inject after pressure tank: peroxide pump is controlled by flow sensor and is fed proportionally based on flow of water

Peroxide injection controlled by existing well pressure switch. Most common method used. Lowest cost.



Peroxide injection controlled by Flow Meter “Proportional Feed.” Allows peroxide injection point to be after pressure tank, or at point of use or entry to home.



Determine Contact Tank Size Required

Typical home well water chlorination and pH adjustment system with 80 gallon contact tank.

Whether you are injecting chlorine with a metering pump or using a solid chlorine pellet feeder, you need a certain amount of contact time after the chlorine has been injected for the chlorine to work properly.

Well Water Flow Rate in GPM X Contact Time in Minutes = Contact Tank Size in Gallon

For example your well pump is pumping at 10 gallons per minute (GPM).

You have coliform bacteria and want 10 minutes of contact time.

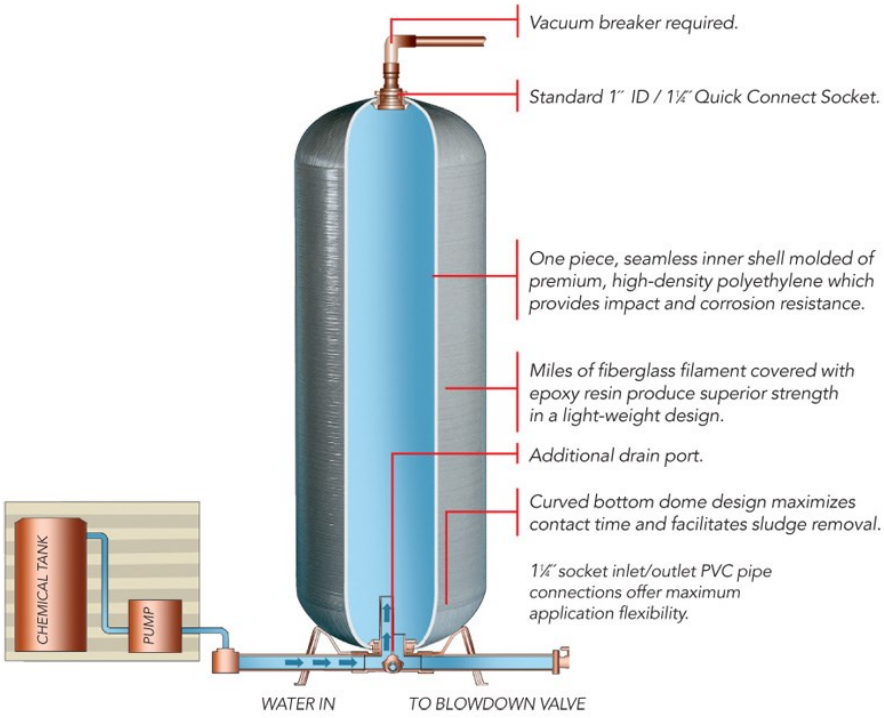
10 GPM x 10 minutes = 100 Gallons

Therefore, you would want a contact tank that held at least 100 gallons of water.

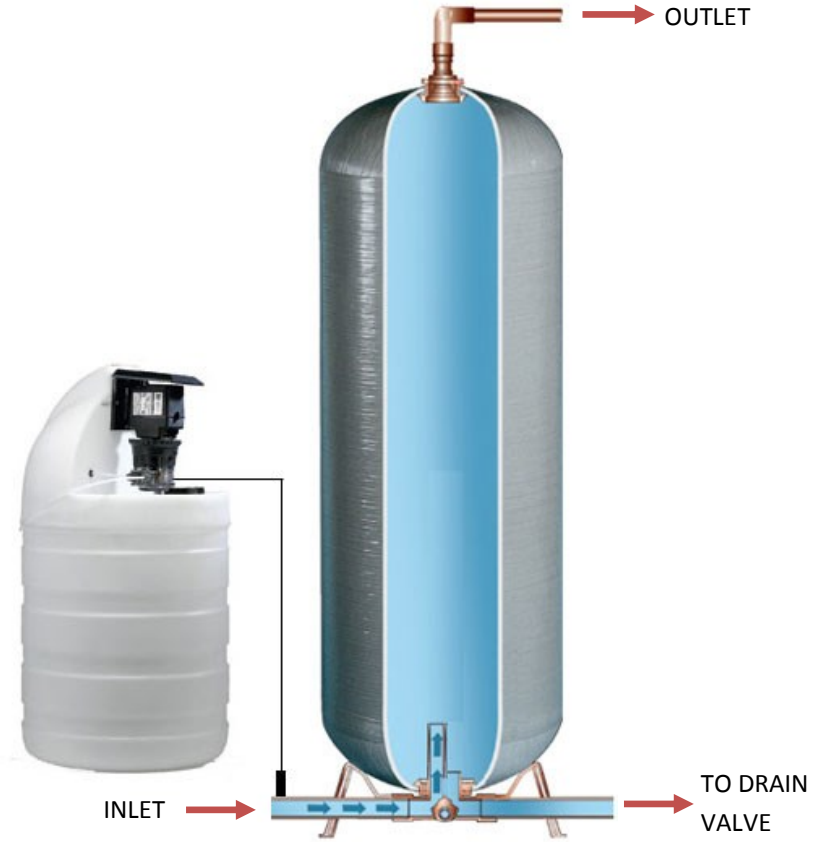
The best contact tanks are like a large pipe, with water entering at one end and flowing out the other end.

Large residential project treating creek water with two 5000 gallon storage/contact tanks.

Contact retention tank. Usually installed after pressure tank.



Two Methods to Set up Contact Tanks



1. Water enters in at bottom, exits at top of tank. This method is the most common, and is useful for settling sand and sediment out in the contact tank. A simple ball valve at the bottom allows you to drain and flush the tank of accumulated iron and sediment.

- Best for most applications
- Provides contact time for disinfection
- Tank easily drained

2. Water enters in at bottom, exits at bottom. This method is useful when air or gasses are present in the water. Water travels up the center tube and then back down through the water. Any gasses or air present accumulate at the top and are vented off by the air vent.

- Best for applications where gasses are present in the well water
- Provides contact time
- Vents off gasses
- Air compressor (optional) can be installed for increased aeration and degassing

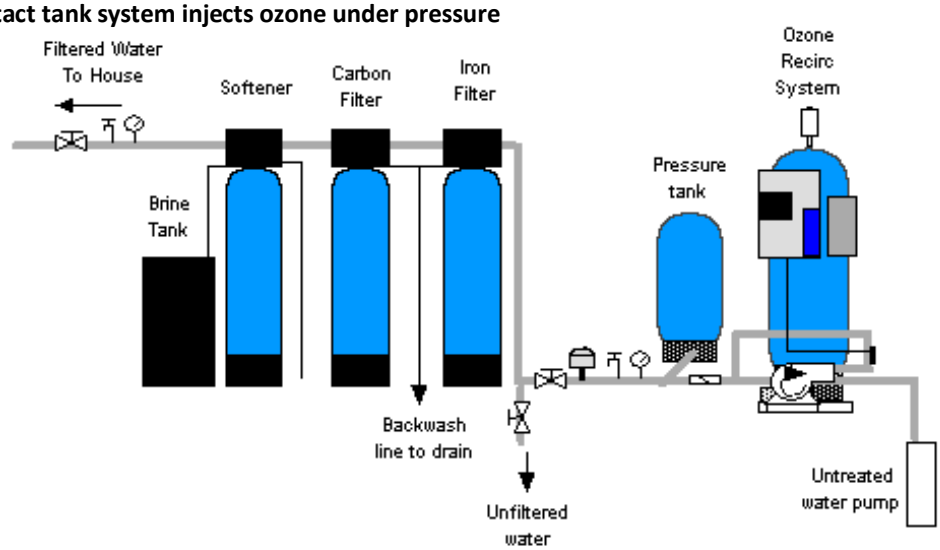
Ozone Gas

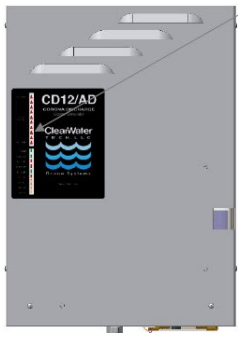
- Ozone gas: more powerful than chlorine or peroxide
- Eliminates odors; oxidizes iron, manganese, and other metals
- Produced on-site automatically
- Leaves no chemical byproducts
- Much more expensive upfront, than chlorine or peroxide

Two main types of ozone generators

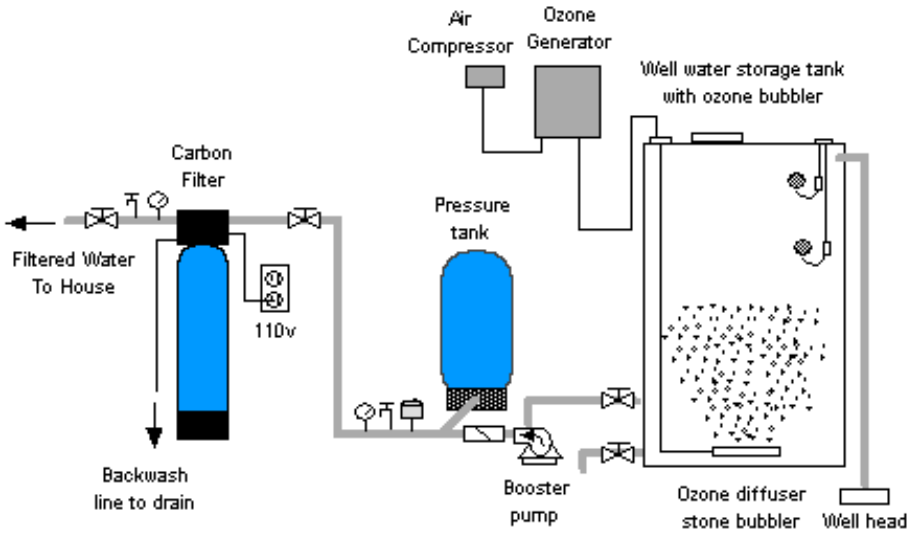
1. Corona-discharge: most powerful
2. UV generated: less ozone, lower cost

Contact tank system injects ozone under pressure





Storage tank system bubbles in ozone in tank



Ozone ("O_2") , is a highly reactive form of oxygen that can quickly destroy odors and bacteria. Larger ozone generators are often required for well water containing high levels of hydrogen sulfide, which can make ozone an expensive method to treat sulfur odors.

Determine Your Well Pump Flow Rate

In order to size your chlorinator, peroxide, ozone or aeration system, it is important to know the flow rate of your well pump in gallons per minute.

Your well pump can pump water up to a certain maximum flow rate in gallons per minute. For example, say you could fill a 5 gallon bucket in 1 minute. This is a flow rate of 5 gallons per minute or 5 GPM. If the water filled up a 5 gallon bucket in 30 seconds, the flow rate would 10 GPM. Knowing how many gallons per minute your water system can pump is critical to picking the right type of water treatment system, and it is easy to determine.

This method works for most well pumps. If your pump turns on at one pressure (typically 30 or 40 PSI) and off at a higher pressure (usually 50 or 60 PSI) this method will work for you.

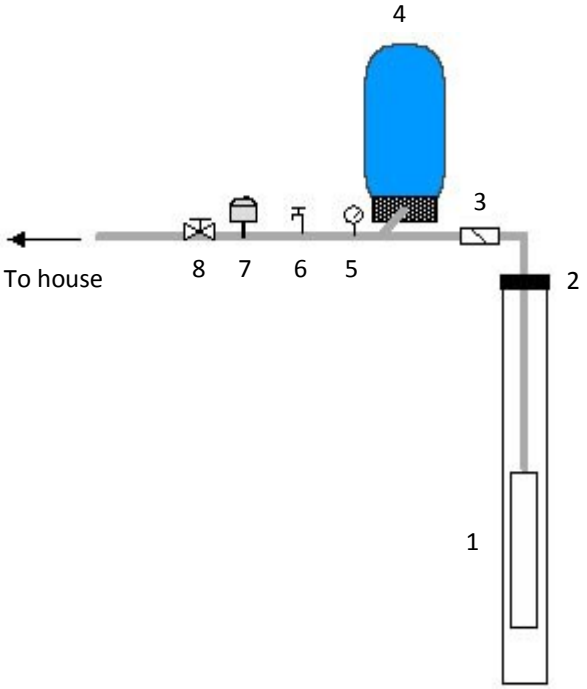
It is easy! All you need is a 1 or 5 gallon bucket and a watch or clock. It takes just a few minutes:

1. Open any hose bib or faucet until pump turns on.
2. Close hose bib or faucet and let pump fill up pressure tank until it turns off.
3. Using a 1 or 5 gallon bucket, open faucet and collect and measure all water discharged until pump turns on.
4. When pump turns on, immediately close faucet and start timing pump cycle.
5. When pump turns off, record pump cycle time to refill pressure tank in seconds.
6. Divide the number of gallons collected in Step 3 by the number of seconds in Step 5.
7. Multiply the answer from Step 6 by 60.
8. The answer in Step 7 is the average pumping capacity of the pump in gallons per minute (GPM).

Click this link to our online calculator to make your calculations more quickly and easily:
http://www.cleanwaterstore.com/technical/water-treatment-calculations/body_flow_rate.html

Pressure Tank with Submersible Well

How It Works: Submersible pump in well (1) is controlled by pressure switch (7). When pressure in pressure tank (4) drops below a preset level (typically 40 to 60 PSI), the pressure switch turns well pump on. Well pump continues to run until pressure in pressure tank builds up, and pressure switch reaches maximum pressure setting. The pressure tank contains a pre-charged air bag to moderate pressure in the piping system.



1 Well pump submerged in water

2 Well head with sanitary seal

3 Check valve (may be submerged in well and not visible)

4 Pressure tank

5 Pressure gauge

6 Hose bib

7 Pressure switch

8 Gate valve

Oxidizing Iron Filters That Also Remove Odors

These iron filters oxidize the dissolved ferrous iron in water to an insoluble particle and trap the iron (rust) in the iron filter media. Some also remove hydrogen sulfide gas along with the iron. A periodic backwash cleans out sediment and flushes the filter media clean. Various types of iron filter media are available including Greensand, Pro-OX©, MangOX©, Filox©, & Pyrolox©.

Generally Birm media is recommended when hydrogen sulfide is present.

Oxidizing iron filters use either air, chlorine, potassium permanganate, hydrogen peroxide, or ozone to aid the filter media in oxidizing the iron.

Catalytic carbon is used with hydrogen peroxide and is the only media not containing manganese dioxide.

Air Charger Sulfur Filter

Greensand Iron Filter

Comparison of Oxidizing Iron Filters

Iron Filter Type	Oxidizers Used	Maximum Recommended Iron Removed in PPM	Maximum Recommended Manganese Removed in PPM	Removes Hydrogen Sulfide?	Backwash Flow Rate Required GPM per Square Ft*	Weight Lbs per cubic foot
Birm©	Air	10	0	No	10 - 12	45
Greensand	Potassium Permanganate, Chlorine, Ozone	15	5.0	Yes	12 - 15	85
ProOX©,MangOX©, Filox©, Pyrolox©	Air, Chlorine, Ozone	20	5.0	Yes	15 - 25	120
Catalytic Carbon	Hydrogen Peroxide	20	5.0	Yes	10-12	35

* Backwash per square foot refers to the Gallons Per Minute required to backwash one square foot of the media. As an example, a 14” diameter tank has approximately a square foot surface area of 1 square foot. A 10” diameter tank has a square feet area of 0.5 square foot. So a 1.5 cubic foot Birm iron filter in a 10” x 54” tank would require 5 gallons per minute for backwash, whereas a MangOX filter would require a backwash flow rate of 8 to 12 GPM.

Greensand Iron Filters

Uses potassium permanganate or chlorine bleach to remove odors and filter iron, manganese, and sulfide residue

Greensand filter media has a special coating of manganese dioxide that oxidizes iron and manganese in water upon contact with the filter media.

Greensand is not affected by chlorination and works over a wider pH range. Greensand iron filters remove manganese and hydrogen sulfide.

To provide the oxidizing power to precipitate iron and manganese the iron filter is automatically cleaned and restored with potassium permanganate (a purple liquid) during each backwash cycle. As an alternative to using potassium permanganate powder, a chlorine injector pump can be used ahead of the Greensand-Plus filter to regenerate the filter media. Greensand media generally needs to be replaced every 4 to 6 years.

When treating water containing both hydrogen sulfide and iron bacteria, it is best to chlorinate the water prior the greensand filter. The injection of chlorine substantially increases the effectiveness of the greensand media, and allows it to work without the use of potassium permanganate and remove higher levels of iron and manganese.

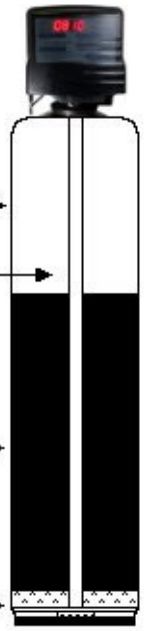
- Removes Ferrous & Ferric Iron
- Removes manganese
- Removes low levels of hydrogen sulfide "rotten egg" odor
- Not affected by iron bacteria
- Works with chlorinated water
- Removes higher levels of hydrogen sulfide with pre-chlorination

What is "Potassium Permanganate"?

Potassium Permanganate ($KMnO_4$) is a purple-black powder and powerful oxidizer. It is used with greensand iron filters to regenerate , clean and restore the oxidizing capability of the greensand iron filter media.

Greensand Filter:

Fully automatic, backwashes based on days of the week and/ or amount of water used.



How it Works: Water flows in from the top down through the Greensand Media, removing iron, manganese, and sediment. Filtered water flows down to the distributor screen, up the distributor tube, and out to the household piping. Once or twice a week, the ay-control valve timer starts a backwash and rinse, called a "regeneration" cycle. This typically occurs in the middle of the night and is completely automatic.

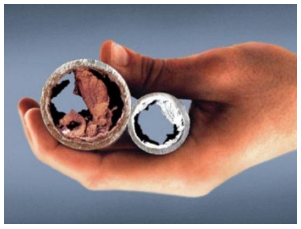
During the regeneration cycle, the Greensand media is first backwashed thoroughly. During the backwash, water flows down the distributor tube and up through the Greensand media and out to drain, flushing out the accumulated iron and manganese and sediment.

After the backwash, some permanganate solution is sucked out of the permanganate tank, and the Greensand is rinsed and regenerated, restoring the exhausted media to a fresh state so that it can continue to remove iron and manganese. The permanganate solution is rinsed out in two rinse cycles, and more water fills the permanganate tank and makes more permanganate solution from the permanganate powder that remains in the permanganate tank.

Eventually the powder will run out, at which time fresh permanganate powder must be added to the tank, typically once every 3—4 months.

Check for Pipe Corrosion and Scale Build-up

Unless your home is new, it is important to check for corrosion and scale build-up in your piping. Fortunately this is not difficult to do using one of the following methods:



- Check for signs of blue stains in fixtures and toilet tanks, which can indicate copper corrosion, and/or test water for copper.

- If you have galvanized iron pipe, look for signs of rust and rust-colored scale in the toilet flush tank.

- If possible, inspect the exterior of pipes and valves for any signs of pinhole leaks or corrosion byproducts which can be crusty, bluish, white, salty looking, or rusty. If you are having any plumbing work done on your house, inspect any sections of the pipes that have been cut to see if there is any scale build-up or signs of corrosion.

How To Identify Pipe Sizes

It is useful to know the size of your incoming pipes. For instance, say you decide you want to install an iron filter system for your house. They come in different pipe sizes, such as ¾" pipe, 1" pipe etc. Generally, you want to make certain you get a system that will not restrict the water flow or pressure, so if you have a 1" pipe, you would want an iron filter that has 1" pipe connectors. Knowing what size piping you have solves this problem.

It is easy to check the size of your pipes: First, check on the pipe itself, as the size will often be labeled or written on the side. If not, the string method described below is probably the best way to determine your pipe's circumference. (Circumference is the distance it takes to go around the pipe once.)

Remove any insulation from the pipe. Using a piece of string about 6" long (or a cloth tape measure) wrap the string around the pipe once and measure to the nearest 1/8 of an inch. Once you have found the circumference, use the chart to the right to find your pipe or tube size.

Pipe Circumference to Pipe Size Chart

Copper Pipe or PEX tubing
2.75" (70mm) = 3/4" pipe
3.53" (90mm) = 1" pipe
4.32" (110mm) = 1 1/4" pipe
5.10" (130mm) = 1 1/2" pipe

Flexible Polyethylene Pipe
2.96-3.33" (75-85mm) = 3/4" pipe
3.74-4.24" (95-108mm) = 1" pipe
4.90-5.57" (124-141mm) = 1 1/4" pipe
5.70-6.28" (145-160mm) = 1 1/2" pipe

Steel Pipe or PVC Plastic Pipe
3.25" (83mm) = 3/4" pipe
4.00"(102mm) = 1" pipe
5.00"(127mm) = 1 1/4" pipe
6.00"(152mm) = 1 1/2" pipe

Treating Odors in Well Water Treatment

CHEAT SHEET

www.cleanwaterstore.com
Clean Water Made Easy.

1. Do The Basics

- ☐ Test Water Chemistry
- ☐ Check Well Water Flow Rate
- ☐ Check for Odors
- ☐ Perform Toilet Tank Check
- ☐ Check Water Heater
- ☐ Check for Pipe Corrosion

2. Decide on Goals

- ☐ Need to Correct pH or Not?
- ☐ Need filtration along with odor removal?
- ☐ Disinfected Water or not?
- ☐ Improve Water Pressure or not?

3. Choose Type

- ☐ Aeration with filtration
- ☐ Hydrogen peroxide with Catalytic Carbon
- ☐ Chlorine with Activate Carbon, and/or Pro-OX
- ☐ Greensand Iron Filter w/ Pot. Permanganate
- ☐ ProOX© , Filox© or Pyrolox© Iron Filter with Continuous Chlorine Feed

4. Installation

- ☐ Buy Direct + Install Yourself OR
- ☐ Buy Direct + Hire a Plumber for Installation OR
- ☐ Buy from Water Treatment Dealer
- ☐ Follow Check List for Best Installation Practices

5. Quality Control

- ☐ Set up Maintenance Schedule + Clipboard with Check List

Questions? Email us at info@cleanwaterstore.com or call toll-free 888-600-5426 or 831-462-8500